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ABSTRACT

This study determined the status of marine education inclusion into K-12 lessons in North Carolina and reflected some inservice parameters. Analysis of a statewide, K-12 survey indicated: (1) 86% of the teachers responding taught some marine concepts in their classes; (2) the criteria for accessing information differed significantly among primary, middle grade, and secondary teachers; and (3) teachers' perceptions on the priority of marine topics and their confidence in teaching those topics were highly correlated. Inservice training opportunities were fewer for primary and middle grade teachers. Inservice programs should be short in length, executed at the school and involve videos to allow teachers to "see" the environment. Primary teachers seem to want materials ready to use with very little involvement on their part. Secondary teachers appear to be more mobile and more able to manipulate materials and curriculum for their own use. (YP)

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A RESEARCH-BASED DESIGN FOR INSERVICE TRAINING IN MARINE SCIENCE FOR PRIMARY, MIDDLE SCHOOL AND HIGH SCHOOL

by

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MARCH 30, 1989

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Abstract

This study determined the status of marine education inclusion into K-12 lessons in North Carolina and reflected some inservice parameters. It explored the first stage--identification of needs--to provide research-based and teacher-driven inservice training developed from a university position.

The method was a statewide, K-12 survey. Analysis of the results included the following information: 86% of the teachers responding taught some marine concepts in their classes; the criteria for accessing information differed significantly among primary, middle grade and secondary teachers; teachers' perceptions on the priority of marine topics and their confidence in teaching those topics were highly correlated.

Implementation of the results will provide a guide for what content topics to include and techniques to design programs according to teachers' needs. Inservice training opportunities are fewer for primary and middle grade teachers. The format should be short in length, executed at the school and involve videos to allow teachers, to "see" the environment. Primary teachers seem to want materials ready to use with very little involvement on their part.

Secondary teachers appear to be more mobile and more able to manipulate materials and curriculum for their own use. Inservice activities in coastal settings are more desired.

In conclusion, extensive sampling of teachers allows inservice programs to be more teacher-driven and more responsive to their needs.

A Research-Based Design for Inservice Training in Marine Science for Primary, Middle School and High School teachers.

THE PROBLEM:

In general, inservice training is neither theoretical, research-based nor teacher driven. This is particularly true from the university position where graduate programs provide most of the inservice opportunities (Lytle, 1983). Lanier and Little (1986) summarized the continuing education trends in the following manner:

> "The relatively private, eclectic, and diffuse character of continuing education thwarts attempts to understand its contribution to teachers' knowledge, competence, and enthusiasm for teaching and makes program effects difficult to evaluate." (Page 548)

Some inservice research relates effectiveness of the program either directly to the teachers (Joyce and Showers, 1980; Lawrenz, 1984) or as passed on to the students (O'Sullivan, et al., 1981). However, the implementation of research results does not appear to be commensurate with the staff development funds and time devoted to inservice activities.

THE NEED:

Lytle (1983) indicated that, as student enrollment has declined, the teaching work force has stabilized. Thus, lower staff turnover rates and increasing length of service are two

factors which have made staff development a priority. The fact that there is a need to develop inservice opportunities appropriate to the needs of teachers is obvious. School year work days are a precious time commodity. Pre-school and post-school inservice time often conflicts with teacher desires. Too often teachers have felt that this time would be best spent in their rooms rather than in inservice training workshops. This indicates a lack of interface between is planned to be presented and what the teachers want.

Inservice training in science education must not only deal with subject matter need, but also methods by which to transfer the information. Nash and Ducharme (1983) argue for more research in inservice education. This includes hypotheses, definitions as well as extensive sampling and involvement of teachers. The survey analysis in this project attempts to add to the growing body of understanding about inservice.

MARINE EDUCATION:

Marine education is a growing segment of science education (Lanier, 1988; Goodwin and Schaadt, 1979). The ocean covers three-quarters of the planet ocean. Eighty percent of the U.S. population is predicted to live within 50 miles of the coast (including the Great Lakes) by the year 2000. There is a distinct need for greater information to be available for teachers. Good materials exist (Chave, et al., 1982; Kolb, 1986). Successful infusion of marine education materials through inservice exposure is the major avenue for change (Walker, 1988).

This project focused on marine education in K-12 schools. One of the goals was to determine, from the teachers' perspective, how to improve their teaching in this area. This included their views on inservice training needs and priorities of topics.

THE METHOD:

A statewide survey measured the perceived levels of knowledge and perceived needs of teachers. The goal was to gain insight in how to develop marine education inservice based on teacher needs.

In March 1987, a packet of information and survey instruments were mailed to principals of 96 schools in the eight education regions in North Carolina. To ensure an equal geographical representation of teachers, a stratified random sample was designed. Principals were asked to provide a survey form to each teacher who taught either science or social studies. Fifty seven percent (57%) of the principals responded. Survey forms from 345 teachers were returned. Data from the survey forms were coded and analyzed using frequency, chi-square, t-tests and correlational statistics using the SAS statistical package.

THE RESULTS:

The demographic distribution of the respondents correspond to the actual distribution of teachers in North Carolina according to Dr. C. J. Brown of the Division of Science

Figure 1. Descriptive Statistics of Teacher Respondents

The eight education regions of North Carolina were collapsed in three zones--mountain, Piedmont and coastal.

The grades were collapsed into three levels--primary, middle and secondary.

57% TOTAL RESPONSE FROM PRINCIPALS

345 SURVEY FORMS RETURNED FROM TEACHERS

DEMOGRAPHICS

BY ZONE

COASTAL SCHOOLS: 35.0%

PIEDMONT SCHOOLS: 41.4%

MOUNTAIN SCHOOLS: 23.7%

BY GRADE

PRIMARY LEVELS (K-3): 39.1%

MIDDLE LEVELS (4-8): 47.2%

SECONDARY LEVELS (9-12): 13.0%

BY GENDER

WOMEN: 84.7%

MEN: 15.3%

Education, NC Department of Public Instruction (Figure 1). Respondents were collapsed into three grade levels--primary (K-3); middle (4-8); secondary (9-12). Geographically, data from the eight regions of the state were collapsed into three regions--mountains, Piedmont and coastal plain (Figure 2).

Survey data showed that 86% of the teachers responding taught some concepts in marine education. This justifies the expenditure of time and effort in developing materials and a model for marine education inservice.

It was important to know the sources for preparation the teachers had for their understanding of marine education in the curriculum (Table 1). Significant points from the survey indicated that primary teachers simply have less preparation than either middle or secondary teachers. They have less inservice training and college courses. Secondary teachers have taken more college courses. All three levels of teachers indicate that their personal experiences form a major base for their preparation to teach marine education.

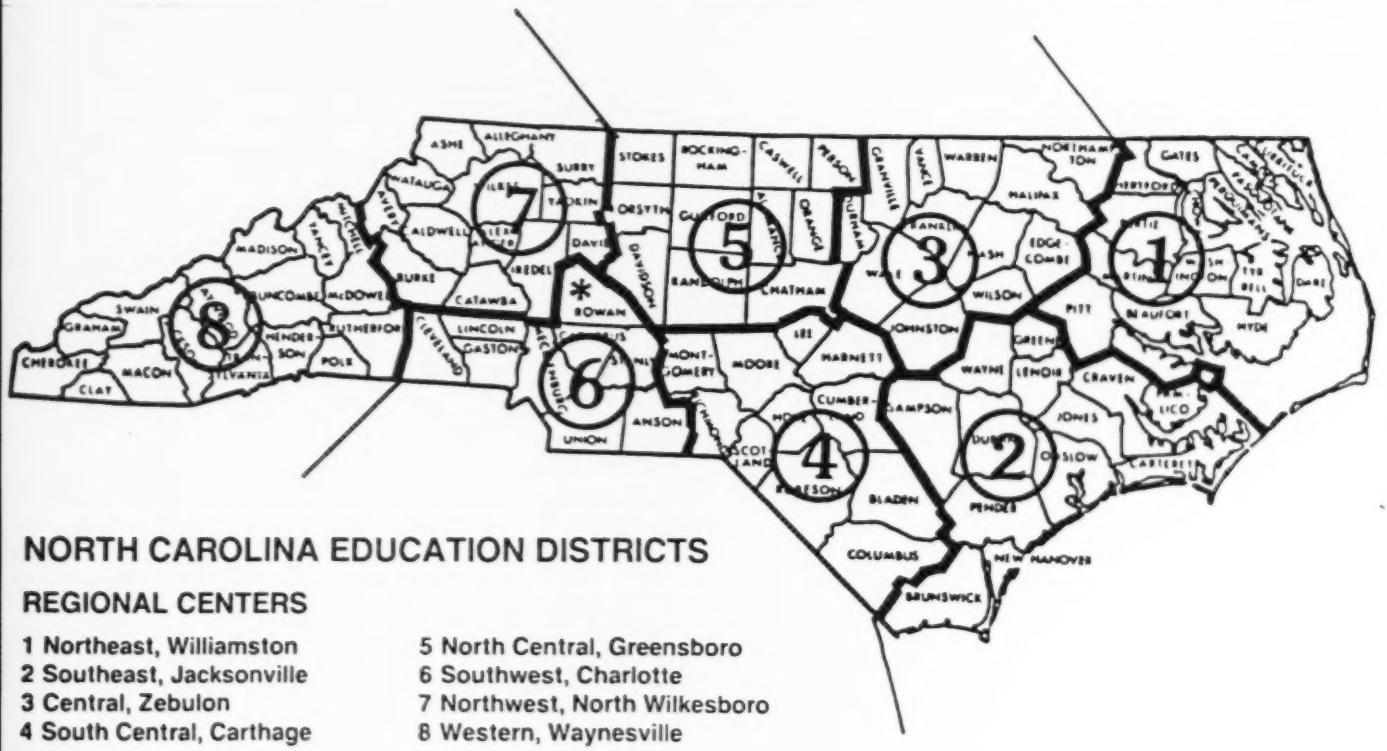
Table 1. "Professional Preparation:" Are there differences in the types of education preparation by grade levels? Percent of teachers within each grade level responding to statements of preparation. (N=283)

	No Education	Workshop/ Institute	College Course	Personal Experience
Primary	40.5	8.6	8.6	46.6
Middle	31.6	18.1	18.8	50.4
Secondary	14.7	26.5	52.9	55.9
Chi Square	8.2*	8.1*	33.9*	2.2

* $p < .05$

Figure 2. North Carolina's eight regional education districts as part of the three geographic regions.

MOUNTAIN PIEDMONT COASTAL PLAIN



NORTH CAROLINA EDUCATION DISTRICTS

REGIONAL CENTERS

1 Northeast, Williamston
2 Southeast, Jacksonville
3 Central, Zebulon
4 South Central, Carthage
5 North Central, Greensboro
6 Southwest, Charlotte
7 Northwest, North Wilkesboro
8 Western, Waynesville

In identifying areas to improve teachers' marine education ability, there were significant differences in the answers among grade levels (Table 2). Secondary teachers willing to travel to inservice opportunities on the coast. It is also obvious that primary and middle-grade teachers desire their inservice in their schools. Middle and secondary teachers have more field trip experience. Both primary and middle grade teachers want more exhibits in their classes. Primary teachers particularly want programs and exhibits that are accompanied by staff. Both primary and middle grade teachers have less administrative support than secondary teachers. All three grade levels indicate less than desired library resources and grade level textbooks.

Teachers had the opportunity to indicate marine topics with which they perceived their own knowledge base and also to indicate their priority from a list of marine topics. When a Pearson correlation coefficient was calculated, the results revealed significant positive relationships ($p<0.05$) in each of the 18 topics between the two variables of teacher's perceived knowledge level and priority for inclusion in the curriculum (Table 3).

Similar forms had been given to teachers in environmental workshops conducted in Mississippi/Alabama and Minnesota (Milkent, 1979; Rakow, 1984). When topics were clustered into major concepts, the perceived knowledge of North Carolina teachers could be compared with teachers in Minnesota and Mississippi/Alabama. When these were ranked, the association among the states was determined using the Kendall coefficient of

Table 2. "What could improve your marine education teaching?"

Grade Level Comparisons (ANOVA and post hoc paired comparison t-test) based on 1-5 Likert-type scale with 1 being the highest. (N=286)

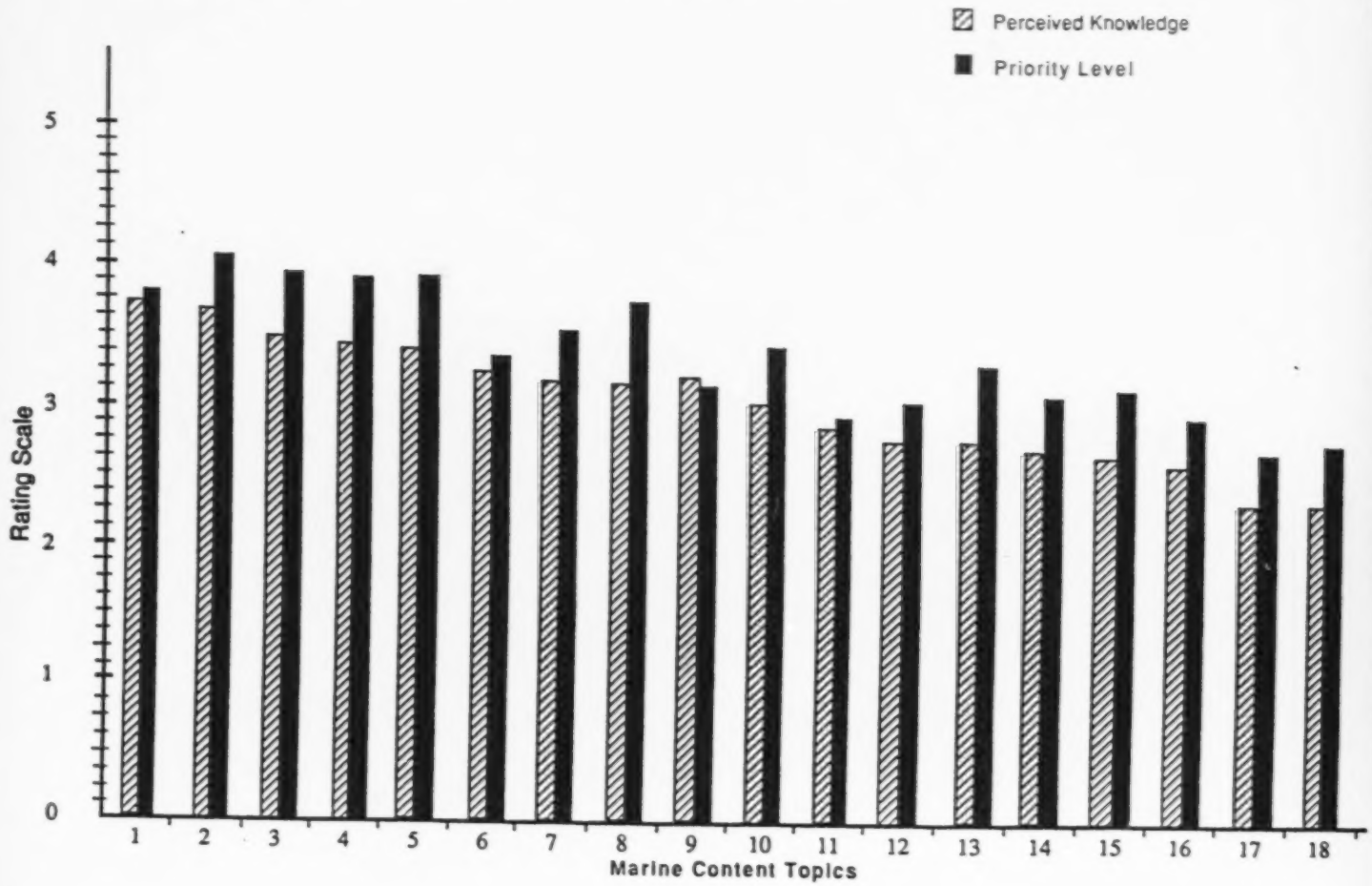
	Primary mean	Middle mean	Secondary mean	F Value
Grade Level Marine Textbook	2.7	2.6	2.2	.3
Library Resources	2.0	2.2	2.2	.4
Short courses near school	2.3	2.1	1.2	.3
Short courses near coast	3.0$_a$	2.6$_a$	1.8	8.48*
Short coastal video tapes	2.1$_a$	1.7$_a$	1.9$_{a,b}$	3.60*
16mm coastal films	2.1	2.0	2.3	.72
Grade Level Curriculum	1.8$_a$	1.6$_a$	2.2	3.91*
Field Trip Experience	3.1	2.6$_a$	2.4$_a$	4.42*
Administrative Support	2.9$_a$	2.7$_a$	2.1	5.80*
Unstaffed traveling exhibits	2.2$_a$	2.0$_a$	3.1	9.98*
Staffed outreach programs	1.6$_a$	1.8$_a$	2.3	4.96*

*$p < .05$

Having the same letter subcripts means there are not significant differences between those pairs.

#6 **Figure 1.**

Mean Ratings of Perceived Knowledge compared to priority given to that topic (average N = 300) Based on a 1 - 5 Likert-type scale with 5 being the highest rating.



1. The water cycle
2. Pollution of water
3. Economic importance of water
4. The sea as a source of food
5. Marine animals
6. Properties of water
7. Influence on people
8. Marine plants
9. Aesthetic value
10. Marine ecology
11. The Gulf Stream
12. Water table/ground water
13. Marine food webs
14. Fisheries industries
15. Conservation legislation
16. Salt marsh / estuaries
17. Freshwater intrusion
18. Mariculture / aquaculture

There are significant, positive correlations between the two variables of teachers' perceived knowledge levels for marine topics and their priority for inclusion of that topic in their curriculums.

Table 3. Perceived Knowledge Level of North Carolina Teachers compared with Priority Level given to each topic (average N=300)

Based on a 1-5 Likert-type scale with 5 being the highest rating.

Topic	Perceived Knowledge Mean	Priority Level Mean
The water cycle	3.74	3.78
Pollution of water	3.65	4.08
Economic importance of water	3.51	3.95
The sea as a source of food	3.45	3.89
Marine animals	3.40	3.91
Properties of water	3.25	3.36
Influence on people	3.18	3.54
Marine plants	3.15	3.74
Aesthetic value	3.23	3.13
Marine ecology	3.09	3.44
The Gulf Stream	2.86	2.90
Water table/ground water	2.76	3.05
Marine food webs	2.76	3.33
Fisheries industries	2.71	3.10
Conservation legislation	2.65	3.13
Salt marsh/estuaries	2.58	2.91
Freshwater intrusion	2.31	2.68
Mariculture/aquaculture	2.31	2.75

There are significant, positive correlations between the two variables of teachers' perceived knowledge levels for marine topics and their priority for inclusion of that topic in their curriculum.

concordance W. W=.609. p <.10. While the association is weak, some patterns emerge from Table 4--properties of waters were considered to have high perceived knowledge in all three states, water in daily lives ranked low.

Table 4. Comparison of perceived knowledge of topic areas clustered into major water concepts among teachers in North Carolina (N=300), Minnesota (N=55) and Mississippi (N=87). (Means of means calculated). Based on Likert-type 1-5 scale with 5 being the highest rank.

Concept Title	NC	MN	MS/Al
Properties of Water	3.25	3.81	2.95
Water in culture and economics	3.03	3.33	2.64
Water Quality Problems	2.98	3.35	2.93
Life in the water	2.98	3.25	2.88
Water is our Daily life	2.65	3.00	2.72
Attitudes about Water	2.31	3.55	2.87

Kendall Coefficient of Concordance: W = .609, P <.10.

The order in which North Carolina teachers evaluated their perceived knowledge and their confidence in teaching those topics shows that teachers have a number of misconceptions. For example, water pollution was given top priority, but freshwater intrusion in the estuaries, a serious type of water pollution in North Carolina, ranked last. The best use of this information is to include clarification of these misconceptions in inservice settings. Using topics with which teachers feel comfortable is a good springboard for introducing new, or replacing misconceived, information.

APPLICATIONS FOR APPROPRIATE INSERVICE DESIGN:

Analysis of the data has yielded information that can be used in planning inservice programs for teachers in North Carolina. Two of the more salient findings are:

1. Primary grade teachers would prefer more visual aids and as much assistance as possible with the content. Consequently, the inservice would be short and show how to use existing curriculum and audio-visual support for the appropriate grade level. The content should enrich weaker areas of marine topics that have significance for North Carolina. The idea is to bring the coast to the teachers.

2. Secondary teachers with apparently greater mobility would travel to the coast to be exposed to both methodology and content. Again, the content would reflect concepts that they consider to be a priority or one in which misconceptions are obvious.

Results of the data available indicate that two models are needed--one for primary and one for secondary programs. Below are the main features:

Primary Model: Workshops held in school; short duration, content focused on topics in curriculum; specific topics were identified that will enrich teacher knowledge of marine issues in North Carolina.

Secondary Model: Workshops held at coastal sites; extended programs; availability of resource materials for marine issues; continued updating of their knowledge base.

IMPLICATIONS:

Extensive sampling of teachers allows inservice programs to be more teacher-driven and more responsive to their needs. It also allows the inservice design staff to develop materials to enrich the knowledge base and focus on priorities identified by marine experts, but not emphasized by teachers. Since the inservice is initiated from a university base, the strengths inherent in faculty involvement and availability of resources can be integrated in the program.

Recommendations derived from this survey are forming the base for designing inservice programs in marine education. The marine topics section can serve as a base for comparing statewide awareness programs, pre-test prior knowledge understanding or post-test evaluations of future inservice programs. Additional research is warranted to compare teacher driven designs with less responsive designs.

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